J. Agric. Sci. Mansoura Univ., 31 (11): 7383 - 7389, 2006

PHYTOCHEMICAL AND TOXICOLOGICAL EFFECT OF CERTAIN PLANT EXTRACTS AGAINST THE COTTON APHID, *Aphis gossypii* GLOVER

Mohamed, M. A.
Department of Vegetable Pests, Plant Protection Research Institute, Dokki, Giza, Egypt.

ABSTRACT

Phytochemical constituents were separated and identified at the length ethanol extracts of leaves of Lantana, *Lantana camara* & seeds of Cumin, *Cuminum cyminum and* Golden shower, *Cassia fistula*. It is clear that, Cumin extract contained high amounts of carbohydrates, glycosides and volatile oil while flavonoides, sterols and triterpenes recorded moderate amounts. On the other hand, phenolic glycoside and cardic glycoside were detected in slight amounts, while tanins and saponin were found in trace amounts in cumin seeds. With respect of Lantana extract, it contained moderate amounts of carbohydrates, glycosides, flavonoides, volatile oil and phelonic glycoside, low amounts of sterols, triterpenes, tannins, cardic glycoside, anthraquinone and alkaloids and trace amounts of saponins. As for Golden shower, its screening showed high amounts of carbohydrates and glycosides, moderate amounts of tanins, low amounts of sterols, triterpenes, alkaloids, saponins & flavonoides and trace amounts of volatile oil.

The efficiency of ethanol extract from Cumin, Golden shower and Lantana plants as expressed in LC50 and LC90 values against adults of *Aphis gossypii* Glover. The ethanol cumin extract which gave 82% mortality at 1.50 mg/cm^2 concentration had the best toxic effect. The extracts obtained from the three plants showed clear insecticidal activity against the tested pest.

Keywords: cotton aphid, *Aphis gossypii* Glover, phytochemical, plant extracts, control.

INTRODUCTION

In recent years, the emphasis in plant protection has definitely shifted from the dominant chemical pesticides to integrated pest management (IPM) where the focus is on biological control and other natural resources with reduced reliance on chemicals. Health and environmental problems and the increasing insect resistance to any of these synthetic pesticides clearly indicate that basic research must be directed to the discovery of new, safe types of pest control agents in order to ensure high production and preservation of agricultural products (Goyal *et al.* 1971, Watson *et al.*1979, Sharma *et al.* 1980, Schmutterer1981, Salem 1983& Saleh *et al.*1986).

Therefore, many plants, trees, Shrubs, annuals, either wild or cultivated were surveyed for their pesticidal activity. These plants were phytochemically investigated to determine their chemical compositions. Several bioactive compounds which proved satisfactory in pest control were isolated, identified and evaluated by researchers. i.e. Rai and Sethi 1972, Su *et al.* 1972, Su 1977, Uebel *et al.* 1979, Afifi *et al.*1992, Dethier *et al.*1994, Singh 1994, Zidan *et al.*1994, Cholchat 1995,Osawa *et al.*1995, Gurib *et al.* 1995, Bignell & Dunlop 1996 and El-Gengaihi *et al.* 1997.

The present investigation aimed to screen phytochemical constituents of Cumin, Golden shower and Lantana plant extracts and studying their toxicity against adults of *Aphis gossypii* Glover.

MATERIALS AND METHODS

1-Tested plants:

The tested plants for this study are listed in Table (1). The experimented plants were free from any pesticide contaminations.

Table 1: Plants investigated for phytochemical and toxicological effect against *Aphis gossypii* Glover:

Family	Species	Common name	Used part
Umbelleferae	*Cuminum cyminum*	Cumin	Seeds
Caesalpiniaceae	*Cassia fistula*	Golden shower	Seeds
Verbenaceae	*Lantana camara*	Lantana	Leaves

2- Preparation of plant samples and extraction

Green Lantana Leaves was washed with distilled water and then left to dry under room conditions and grounded, while dry seeds were ground directly in a grinder. The dry plant materials were ground to a coarse powder. Extraction was carried out according to the method adopted by Freedman *et al.* (1979) with minor modification (where ground leaves and seeds were soaked in the chosen solvent instead of using soxhlet procedure). Then 150 gm. of each plant material were extracted with about 750 ml of ethyl alcohol 95%.

3- Preliminary screening of the phytochemical constituents in plant extracts.

Preliminary phytochemical tests were carried out on the extracts of the dried powder of the different plant parts as follows:

A- Extraction with ethanol then extract was evaporated until dryness.

B- Detection of natural compounds

The following biochemical constituents were determined

1- Sterols and triterpenes: sterols and triterpenes were determined according to the method adapted by Wall *et al.* (1964)

2- Tanins: Tanins were determined by the method described by claus (1961).

3- Phenolic glycosides: Balbaa (1981) determined Phenolic glycosides by the following procedure. Some drops of sulfuric acid were added to 1 ml plant extract, a red color was produced which disappears on the addition of water.

4- Cardic glycosides: Cardic glycosides were determined according to Balbaa (1981).

5- Anthraquinone glycosides: Anthraquinone was calculated according to Balbaa (1981).

6- Alkaloids: Alkaloids were estimated by the method described by Romo (1966).

7- Saponins glycosides: Saponins glycosides were calculated according to the method mentioned by Wall *et al.* (1964).
8- Flavonoids: Flavonoids were determined according to the method adopted by Claus (1961).
9- Carbohydrates and glycosides: Carbohydrates and glycosides were determined using the method adopted by Karawya and Abd El- Wahab (1975).
10- Volatile oil: Volatile oil was detected according to Wallis (1967).

4- Toxicity tests:

The cotton aphid, *A. gossypii* used in the present study was obtained from laboratory colonies free of insecticide contamination. The cotton aphid reared according to Norman and Sutton (1967).

According to Potter (1952) direct spray was employed in the present experiment for estimation of the toxicity of the three plant extracts on the apterous adults of cotton aphid. Petri dishes 9 cm. in diameter were sprayed with plant extract. Five concentrations of each extract were used. Four replicates for each concentration and control were used. The insects were confined within the treated surface for 60 minutes and then transferred to clean Petri dishes containing fresh leaves (cucumber). After 24 hours the dead aphids were counted and % mortality was calculated and corrected from the natural mortality when needed according to Abbot's formula (1925). Data were statistically analyzed according to simple regression line method (Snedecor, 1950) and plotted on probit analysis papers.

RESULTS AND DISCUSSION

1-Preliminary screening of the phytochemical components

In general, data in Table (2) indicated the existence of ten phytochemical components in Lantana leaves and seeds of Cumin& Golden shower, but in various amounts according to plant species.

Table 2: Preliminary phytochemical screening of different plant extracts.

Plant extraction constituents	Plant used		
	Cumin	Golden shower	Lantana
Sterols and titerpenes	++	+	+
Tanins	±	++	+
Phenolic glycoside	+	+	++
Cardic glycoside	+	+	+
Anthraquinone	++	+	+
Alkaloids	++	+	+
Saponins	±	+	±
Flavonoids	++	+	++
Carbohydrates and glycosides	+++	+++	++
Volatile oil	+++	±	++

+++ High amount ++ Moderate amount
+ Slight amount ±Trace amount

It is clear that, *Cuminum cyminum* (Cumin), contained high amounts of carbohydrates, glycosides and volatile oil while flavonoides, sterols and triterpenes, alkaloids and anthraquinone were recorded a moderate amounts. On the other hand, phenolic glycoside and cardic glycoside were detected in slight amounts, while tanins and saponin were found in trace amounts in cumin seeds. In respect of *Lantana camara* contained moderate amounts of carbohydrates, glycosides, flavonoides, volatile oil and phelonic glycoside, low amounts of sterols, triterpenes, tannins, cardicglycoside, anthraquinone and alkaloids and trace amounts of saponins.

As for *Cassia fistula* its screening showed high amount of carbohydrates and glycosides, moderate amounts of tanins, low amounts of sterols, triterpenes, alkaloids, saponins & flavonoides and trace amounts of volatile oil.

From the obtained results it can be concluded that sterols, triterpenes, carbohydrates, glycosides, flavonoides, anthraquinone, phenolic glycoside and alkaloids are found in varying amounts in all tested plants. These compounds mostly act as pesticide agents (Su, 1984 and 1990). Edwards *et al.* (1993) studied the terpenoid composition of 6 species of Eucalyptus. All 6 Eucalyptus species showed that cineole (eucalyptol) content ranged from 13 to 78% of the total oil. Afifi *et al.* (1992) reported that the insecticidal activity of sapnut tree may be attributed to the existence of sterols, triterpene and glycosides. In same trend, Shlosbera *et al.* (1996) reported that, dry tomato vines contain potentially harmful steroid alkaloids and many of Solanacea contain steroid alkaloids, particularly solanine, which is hydrolyzed to the aglycone solanidine and toxic saponin tomato plants contain the glyside tomatine which is also toxic.

2-Toxicity of three ethanolic plant extracts to *Aphis gossypii*.

The principal in the selection of the tested plant species was their usage due to their medicinal and/or insecticidal properties. The toxicity and the effectiveness of the control agents Cumin, Golden shower and Lantana on *Aphis gossypii* Glover were determined and showed some variations in their action as presented in Table (3). The % mortality resulted from exposing the aphids to different concentrations of the tested plant extracts were tabulated in Table (3). The LC50 and LC90 values were tabulated in Table (4), with their corresponding slops.

Table 3: Effect of Cumin, Golden shower and Lantana as ethanolic plant extracts on the apterous adults of *Aphis gossypii* Glover

Ethanolic plant extracts					
Cumin		Golden shower		Lantana	
Conc. mg/ cm^2	% mortality	Conc. mg/ cm^2	% mortality	Conc. mg/ cm^2	% mortality
0.20	12	0.25	5	0.30	7
0.35	60	0.35	11	0.40	10
0.70	65	0.70	40	0.90	36
1.25	73	1.25	59	1.50	54
1.50	82	2.25	78	2.50	75

Table 4: Toxicity of ethanol plant extract of Cumin, Golden shower and Lantana against apterous adults of *Aphis gossypii* Glover.

Plant extracts	LC50 mg/ cm^2	LC90 mg/ cm^2	Slope
Cumin	0.46	2.29	1.85
Golden shower	1.05	3.63	2.38
Lantana	1.32	4.59	2.36

From Table (4), it is clear that all the tested plant extracts are effective on *A. gossypii*. Cumin showed the most efficient toxicant against aphids, with the lowest LC50 value followed by Golden shower and finally Lantana. Also data showed that Golden shower recorded the highest slope value indicating high homogeneous response of the individuals to the concentration tested.

These results are agreement with several investigators. Jacobson (1975), who reported that leaf extract of *Lantana camara* in water, was toxic to the black bean aphid, *Aphis rumicis*, however topical application of its flower extract was found to be toxic to the rice brown plant hopper, *Nilaparavata lugens* (Moroallo Rajessus, 1984).

Satapathy (1983) reported that the leaf extract of *Cassia fistula* in water showed insecticidal activity when tested against the pulse beetle under controlled conditions. El-Halawany *et al.* (1988) reported that cumin oil was more toxic to egg and adult stages of *Tetranychus urticae*.

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التركيب الكيميائى والتأثير السام لبعض المستخلصات النباتية ضد حشرة من القطن

منى عبد الحميد محمد
معهد بحوث وقاية النباتات- مركز البحوث الزراعية- الدقى- الجيزة- مصر.

تناولت الدراسة فصل المكونات الداخلية لمستخلصات الايثانول لاوراق نبات اللانتانا وبذور الكمون والخيار شنبر. أوضحت النتائج التى أسفرت عنها الدراسة أن مستخلص بذور الكمون يحتوى على كمية عالية من الكربوهيدرات، الجليكوسيدات والزيوت الطيارة بينما الفلافونويدات، الاستيرولات والتربينات وجدت بكميات متوسطه. ومن جهه أخرى وجدت الجليكوسيدات الفينولية والكردونية بكميات قليلة بينما التأنينات والسابونين وجدت بكميات ضئيلة فى بذور الكمون. وأظهرت النتائج فيما يتعلق بمستخلص أوراق نبات اللانتانا أنها تحتوى على كمية متوسطة من الكربوهيدرات ، الجليكوسيدات ، الفلافونويدات ، الزيوت الطيارة . والجليكوسيدات الفينولية بينما تحتوى على كميات منخفضة من الاستيرولات ، التربينات ، التأنينات ، الجليكوسيدات الكردونية ، الانثراكينونات والكالويدات بينما كميات ضئيلة من السابونين .وتناولت الدراسة أيضا فصل المكونات الكيميائية لمستخلص بذور الخيار شنبر حيث وجد به كميات عالية من الكربوهيدرات والجليكوسيدات بينما كميات متوسطة من التأنينات وكميات منخفضة من الاسيرولات ، التربينات ، الكالويدات ، السابونين والفلافونويدات وكميات ضئيلة من الزيوت الطيارة .

تناولت التجارب دراسة كفاءة كل من مستخلص بذور الكمون والخيار وأوراق نبات اللانتانا ضد حشرة من القطن. وأوضحت النتائج المتحصل عليها أن أفضل المستخلصات هو مستخلص الايثانول لبذور الكمون حيث أعطى نسبة موت (٨٢%) عند تركيز (٠ر١ ميلجرام/سم٢) وأن المستخلصات الثلاثة المختبرة لها تأثير ابادى واضح ضد حشرة من القطن .